

Preliminary Closeout Report

Naval Weapons Industrial Reserve Plant, Bedford

Bedford, Massachusetts

CERLCIS ID MA6170023570

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Region 1, New England
Boston, Massachusetts



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LIST OF ACRONYMS

AMRAD	Advanced Medium Range Air-to-Air Missile Development
AOC	Area of Concern
APD	Aquifer Protection District
ARAR	Applicable, Relevant and Appropriate Requirement
AWQS	Ambient Water Quality Standards
BNA	base neutral acid extractable organic compounds
BTEX	Benzene, toluene, ethylbenzene, xylenes
CCR	Construction Completion Report
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CHF	Contaminant hazard factor
COC	Constituent of Concern
1,2-DCE	1,2-dichloroethene
DERA	Defense Environmental Restoration Account
DNAPL	Dense, non-aqueous phase liquid
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
ERA	Ecological Risk Assessment
ERM	Effects Range Median
ESD	Explanation of Significant Differences
FCOR	Final Closeout Report
FFA	Federal Facility Agreement
FS	Feasibility Study
FTF	Flight Test Facility
GAC	Granular Activated Carbon
GUVD	Groundwater Use and Value Determination
GWTP	Groundwater Treatment Plant
HHRA	Human Health Risk Assessment
IAS	Initial Assessment Study
IR	Installation Restoration
IRA	Interim Remedial Action
ISCO	In-situ chemical oxidation
LTM	Long-term monitoring
LUC	Land Use Control
LUC RD	Land Use Control Remedial Design
MADEQE	Massachusetts Department of Environmental Quality Engineering
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MNA	Monitored natural attenuation
MOU	Memorandum of Understanding
MPF	Migration pathway factor
NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Department of the Navy

LIST OF ACRONYMS (continued)

NEESA	Naval Energy and Environmental Support Activity
NFA	No Further Action
NIRAP	Naval Industrial Research Aircraft Plant
NPL	National Priorities List
NWIRP	Naval Weapons Industrial Reserve Plant
OU	Operable Unit
PA/SI	Preliminary Assessment/Site Investigation
PCB	polychlorinated biphenyls
PCOR	Preliminary Close-Out Report
PP	priority pollutants
PDI	pre-design investigation
PRAP	Proposed Remedial Action Plan (Proposed Plan)
RA	Remedial Action
RAO	Remedial Action Objective
RC	Response complete
RD	Remedial Design
RF	Receptor factor
RI	Remedial Investigation
RIP	Remedy-in-place
ROD	Record of Decision
SFTA	Southern Flight Test Area
SMP	Site Management Plan
SSA	Site Screening Area
SSP	Site Screening Process
STM	Short Term Measure
SVOC	Semi-volatile organic compound
TAL	Target Analyte List
TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TCL	Target Compound List
Tetra Tech	Tetra Tech, Inc.
TPH	Total petroleum hydrocarbon
U.S. EPA	U.S. Environmental Protection Agency
UST	Underground storage tank
UU/UE	Unrestricted Use/Unrestricted Exposure
VOC	Volatile organic compound
VPH	Volatile Petroleum Hydrocarbons

1.0 INTRODUCTION

This Preliminary Closeout Report (PCOR) documents the completion of all physical, remedial construction activities which were performed at Naval Weapons Industrial Reserve Plant, Bedford (NWIRP) Superfund Site (EPA ID MA6170023570). This PCOR was prepared in accordance with *Closeout Procedures for National Priorities List Sites* (OSWER Directive 9320.2-22 dated May 2011). EPA conducted a pre-final inspection on September 23, 2013. All components of the remedy were constructed in accordance with EPA-approved plans and specifications. No outstanding items were identified and thus no additional remedial construction is anticipated at the Site.

Performance of Five-Year Reviews; Operation & Maintenance (O&M) including continued operation of the Groundwater Treatment Plant (GWTP); implementation of Institutional Controls; and performance of Long-Term Monitoring will continue to ensure that the remedy continues to be protective in accordance with the 2010 Record of Decision (ROD) as amended by an Explanation of Significant Differences (ESD) in 2013.

2.0 SUMMARY OF SITE CONDITIONS

2.1 PHYSICAL DESCRIPTION

NWIRP is located in eastern Massachusetts in the Town of Bedford, in Middlesex County, Massachusetts (Figure 1). The property, which is in the southwest portion of Bedford, is approximately 14 miles northwest of downtown Boston. It is bounded by the Lawrence G. Hanscom Field (Hanscom Field) and Hanscom Air Force Base (HAFB) to the south; by Raytheon Electronic Systems Facility, a Patriot Integration Test Facility, wetlands, and residences to the west; by woods and wetlands to the north; and by woods, residences, and wetlands to the east. NWIRP's mission was to design, fabricate, and test prototype equipment for missile guidance and control systems.

NWIRP is divided into northern and southern sections that are separated by Hartwell Road (Figure 2), which provides the only paved ground access to the Activity, aside from the Hanscom Field taxiways. The northern section (North Activity) is located on Hartwells Hill, and consists of the Components Laboratory and its auxiliary buildings, the Compact Test Range (formerly the Advanced Medium Range Air-to-Air Missile Development (AMRAD) Building), the Facilities Storage Building, the Antenna Range Facility, a former incinerator, the Government Building, and the Vitro Tower. The auxiliary buildings associated with the Components Laboratory are the Air Conditioning Room (Cooling Tower), the Incinerator Building, and various storage buildings. The areas in between the buildings are mostly paved for parking, driveways, and walkways. Hartwells Hill drops off steeply to the north and east, and more gradually to the south and west.

The southern section (South Flight Test Area or SFTA), located adjacent to Hanscom Field immediately south of Hartwells Hill, consists of the Flight Test Facility (FTF), the Deluge Pump Station, a Guard House, a parking lot, a small storage building, and a concrete apron surrounding three quarters of the FTF with access to the taxiways and runways of Hanscom Field. The area is almost completely paved, except for the area near the Deluge Pump Station and the vacant area that the Old Hangar and associated buildings once occupied to the east of the FTF.

2.2 OPERATIONAL HISTORY

NWIRP was created in October of 1952 when construction of the Naval Industrial Reserve Aircraft Plant (NIRAP) began. Its mission was to provide the Raytheon Manufacturing Company of Waltham, Massachusetts with facilities for research and development of radar, missile guidance systems, and related equipment. By the mid-1950s, when the Components Laboratory was added and most of the construction was complete, NIRAP encompassed approximately 98,000 square feet of space with an additional 53,000 square feet comprised of guard houses and test shelters. The Old Hangar, formerly operated by Transonics, was in existence from 1941/42 until it was demolished in 1995. The Plating Laboratory, Hawk, Lark, and Van Duesen buildings were constructed in 1952, and the FTF was constructed in 1959. Subsequently, the Navy built the Facilities Storage and Government Buildings near the Northern Activity boundary, and the Antenna Range and Transportation Buildings between them. Finally, the Navy built the air conditioning and incineration facilities, and the Compact Test Range.

2.3 SITE HISTORY

The Navy initiated its IR Program at NWIRP in 1985 by conducting a Preliminary Assessment (PA) in April 1986. After a review of records and available data at the completion of the PA a Remedial Investigation (RI) was recommended for OU2 and OU3. The Navy initiated the RI and Feasibility Study (FS) Phase in 1988. The results are reported in the RI Phase I Findings Technical Memoranda (Dames & Moore 1990a, 1990b, and 1992) Reports. The RI Phase II Work Plan was completed in May 1992 (Brown & Root Environmental 1992), and site characterization activities were conducted between October 1992 and August 1993. The Phase II program identified OU1 and OU4. The final RI Phase II Report was completed in September 2000 (Tetra Tech).

A Short-Term Measure (STM) Investigation later referred to as an Immediate Response Action and then as an Interim Remedial Action (IRA) under the provisions of the Massachusetts Department of Environmental Protection's (MADEP's) Massachusetts Contingency Plan (MCP), was conducted concurrently with the RI Phase II Investigation. The STM Report was completed in April 1993 (Halliburton NUS 1993), and following completion of the design, the GWTP was constructed by the western property line for plume migration control. The GWTP has been operating since February 1997 to capture and treat impacted groundwater associated with OU1.

Operable Units	
OU1	Chlorinated Solvent Groundwater Plume (inc. SFTA and the Northern Plumes)
OU2	Old Incinerator Ash Disposal Area
OU3	Components Laboratory Fuel Tank
OU4	Benzene, Toluene, Ethylbenzene, Xylene Plume

NWIRP was proposed on 23 June 1993 (58 FR 34018) and placed on the National Priorities List (NPL) on 31 May 1994 (59 FR 27989).

The draft RI Phase II Report was submitted in January 1997 for regulatory review. Based on comments received from the regulatory agencies on the draft RI Phase II Report and subsequent discussions, the Navy conducted supplemental investigations at OU1 and OU4 with U.S. EPA approval. These efforts culminated in the completion of the RI, as documented in the revised RI Phase II Report, submitted in September 2000 (Tetra Tech).

Records of Decision (RODs) selecting no further action (NFA) for OU 2 (EPA Doc #9701) and OU3 (EPA Doc #9703) were signed in September 2000.

The OU1 ROD (EPA Doc #469176) was signed in September 2010 which presented the selected remedy of in-situ enhanced bioremediation for the source area, continued operation of the IRA system for plume migration control, monitored natural attenuation (MNA), land use controls (LUCs), and 5-year reviews. The OU1 Remedial Design (RD) was completed in January 2012 and the Remedial Action (RA) Work Plan was completed in April 2012. The Navy commenced construction of the OU1 RA in the summer of 2012. Full-scale operations for the OU1 RA commenced in November 2012. The Remedial Action was considered complete by EPA on August 27, 2014.

The OU4 ROD (EPA Doc #457352) was signed in September 2009. The selected remedy for OU4 includes MNA for groundwater, LUCs, and 5-year reviews. The Remedial Action was considered complete by EPA on August 8, 2013.

The Navy has been conducting a semi-annual groundwater monitoring program at the SFTA since 2002. In summer 2008, the Navy and Air Force signed a Memorandum of Understanding (MOU) regarding the residual contamination in bedrock groundwater at the SFTA. The Navy is currently working to transfer the SFTA property and conducted a supplemental sampling event in February 2013 to provide additional information needed to support an environmental decision document for the property. The Navy completed an Explanation of Significant Differences (ESD) in March 2014 for the OU1 ROD which incorporates the SFTA property into the MNA program and LUCs established with the OU1 RA.

The Navy is continuing its groundwater monitoring program at OU1 (including the SFTA) and OU4. The first of the CERCLA 5-year reviews for NWIRP was completed in 2014.

3.0 REMEDIAL ACTION

3.1 OU1 - CHLORINATED SOLVENT GROUNDWATER PLUME

Northern Activity

The Navy's Phase I RI (Dames & Moore 1990a and 1992) reported the presence of chlorinated volatile organic compounds (VOCs) in groundwater at the northern portion of

NWIRP near the Facility Storage Building and the Components Laboratory. OU1 consists of subsurface source area containing dense non-aqueous phase liquid (DNAPL) in saturated subsurface soil, and an associated dissolved-phase plume of chlorinated VOCs in groundwater. The well-delineated, dissolved-phase plume begins at the source area near the Components Laboratory loading docks, and primarily migrates to the northwest into an off property wetland area (Figures 3 & 5). The primary constituents of the plume are 1,1,1-trichloroethane (TCA) and Trichloroethene (TCE) and their respective breakdown products

The Navy finalized the OU1 FS in June 2010, issued a Proposed Remedial Action Plan (PRAP) in July 2010, and signed the final ROD in September 2010. The selected remedy consists of source area treatment using in-situ enhanced bioremediation, continued operation of the GWTP system, MNA, LUCs, and 5-year reviews. The Land Use Control Remedial Design (LUC RD) was completed in December 2011. The Navy completed the final RD in January 2012 and the final RA Work Plan in April 2012. The Sampling and Analysis Plan to support the source area bioremediation monitoring program was completed in August 2012.

Source Area: The Navy commenced construction of the OU1 bioremediation system in July 2012. Injection equipment, instrumentation, and the control system that would interlock with the existing GWTP system controls were installed per the specifications of the Basis of Design for OU1 (Tetra Tech, 2012). Overall system installation and testing ran from August till October 2012 with demobilization concluding on November 21, 2012. EPA conducted a pre-final inspection on September 23, 2013. The Remedial Action was considered complete by EPA on August 27, 2014.

The bioremediation system employs anaerobic reductive dechlorination (ARD) as the primary biological degradation process to treat the COCs in the OU1 source area and transform CSVOCs to innocuous compounds such as carbon dioxide, ethene, ethane, and chloride. Full-scale implementation of the remedial design includes the application of an electron donor (carbon) substrate throughout the source area from approximately 5 feet below the top of the groundwater table approximately 25 feet below ground surface [bgs]) to a depth of approximately 60 feet bgs. To date, approximately 750 gallons of Lactoil have been successful injected into the aquifer. The injection design network can be seen in Figure 4.

Groundwater: The GWTP system has been operating since February 1997 and consists of twenty-three groundwater extraction wells installed to prevent any further migration of the chlorinated solvent groundwater plume by pumping the water out of the ground. Extracted groundwater is treated onsite in the plant using a technology called granular activated carbon (GAC). When groundwater contacts the GAC, contaminants separate from the groundwater and transfer onto the carbon. The treated groundwater is then released onto the ground surface. Data collected to evaluate system performance indicate cumulative mass removal as of January, 2014 is 133.49 lbs. of VOCs based on 500,000 gallons of influent per month.

Selected Remedies	
OU1	Groundwater Restoration
OU2	No Further Action
OU3	No Further Action
OU4	Monitored Natural Attenuation

Quarterly performance monitoring continues and the need for additional rounds of injection will be evaluated based on these and other data trends.

OU1 — Chlorinated Solvent Groundwater Plume — Northern Plume Findings	
Source of Contamination	One suspected source is a documented spill of 1,1,1-trichloroethane, purchased by Raytheon from Axton-Cross under the name Axothene. Approximately 55 gallons of Axothene was spilled from a ruptured drum to a storm drain on the north side of the Components Laboratory.
Nature and Extent of Contamination	<p><i>Groundwater:</i> VOCs were detected at a maximum concentration of 240,000 µg/L (TCE). VOCs were detected in excess of MCLs in several locations.</p> <p><i>Surface Water (Elm Brook):</i> VOCs were detected at maximum concentrations of 30 µg/L (1,2-DCE) and 27µg/L (TCE).</p>
Decision Documents	<p>Record of Decision - 9/29/10</p> <p>Explanation of Significant Differences - 3/14/14</p>
Remedial Action Objectives (RAOs)	<p>Mitigate the identified unacceptable risks to human health associated with the use of OU1 groundwater as a drinking water supply by reducing the concentrations of 1,1-DCE, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, 1,1,2-TCA, PCE, TCE, and VC in groundwater to cleanup levels.</p> <p>Prevent the use of onsite groundwater for human consumption until groundwater cleanup levels have been achieved on site.</p> <p>Prevent the migration of 1,1-DCE, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, 1,1,2-TCA, PCE, TCE, and VC in groundwater at concentrations greater than cleanup levels.</p>
Remedial Action	<p>An IRA was operated from 1997 to 2010 for groundwater extraction and treatment (plume capture) and included a semi-annual groundwater monitoring program. A thermal treatment pilot study was conducted in 2003 in the source area. An additional source area investigation was conducted in March 2010 to aid in the remedy selection. The Navy issued a Proposed Plan in July 2010 and signed a ROD in September 2010 that specified in-situ bioremediation of the source area, continued operation of the groundwater extraction system, monitored natural attenuation of the remaining plume, LUCs, and 5-year reviews. The Remedial Design was completed in January 2012. EPA conducted a pre-final inspection on September 23, 2013. The Remedial Action was completed on August 27, 2014. An ESD was signed in March 2014 for the ROD in order to incorporate the SFTA into the OU1 Remedial Action. The 5-year review was finalized in September 2014. Remedial timeframe is 80 years (2094).</p>

CVOCs remain at concentrations exceeding the cleanup goals in groundwater samples. Elevated COC concentrations remain at wells (MW-12R, MW-12S, MW-13R, MW-20R, and MW-21R) located near the OU1 source area. Thirteen of the 22 sampled monitoring and extraction wells have one or more COC concentrations that exceed cleanup goals, and eight of those wells (BG-1B, MW-12R, MW-12S, MW-13R, MW-13S, MW-14R, MW-20R, and MW-21R) are located on Navy

property, while four wells (EW-01, EW-04, EW-15, and EW-21) are in the extraction well area north of the facility boundary.

Current monitoring activities at OU1 consist of semi-annual groundwater sampling, in accordance with the 2010 ROD and the Final SAP (AGVIQ-CH2M HILL, 2012), which have been conducted in accordance with this schedule for 4 years (2011 to 2014). LTM of CVOCs in groundwater and MNA assessments are performed to verify that the overall plume is attenuating at a rate consistent with the 80yr remedial timeframe set forth in the ROD. There has been minor change in total CVOC concentration in the majority of OU1 wells indicating that natural attenuation, in conjunction with the extraction system, is largely controlling plume stability.

OU1 — Chlorinated Solvent Groundwater Plume — SFTA Findings	
Source of Contamination	Unconfirmed
Nature and Extent of Contamination	<p><i>Soils:</i> SVOC detected at maximum concentration to 1,800 µg/kg (di-n-butylphthalate).</p> <p><i>Groundwater:</i> VOC detected in shallow groundwater at maximum concentration of 10 µg/L (TCE). VOC detected in bedrock groundwater at maximum concentration of 250 µg/L (TCE).</p>
Decision Documents	<p>Record of Decision - 9/29/10</p> <p>Explanation of Significant Differences - 3/14/14</p>
Remedial Action Objectives (RAOs)	<p>Mitigate the identified unacceptable risks to human health associated with the use of OU1 groundwater as a drinking water supply by reducing the concentrations of 1,1-DCE, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, 1,1,2-TCA, PCE, TCE, and VC in groundwater to cleanup levels.</p> <p>Prevent the use of onsite groundwater for human consumption until groundwater cleanup levels have been achieved on site.</p>
Remedial Action	<p>Prevent the migration of 1,1-DCE, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, 1,1,2-TCA, PCE, TCE, and VC in groundwater at concentrations greater than cleanup levels.</p> <p>A semi-annual groundwater monitoring program is currently in place. Only one contaminant (TCE) remains above groundwater standards at the SFTA (maximum detection of 38 µg/L of TCE compared to a standard of 5 µg/L). TCE concentrations continue to decrease over time. An ESD incorporating SFTA into OU1 was finalized in 2014 (monitored natural attenuation, LUCs, 5-year reviews). A 5-year review was finalized in September 2014. Remedial timeframe is 20 years (2034).</p>

Southern Flight Test Area (SFTA): The 1990 Phase I Supplemental Investigation also identified chlorinated VOCs in groundwater south of Hartwell Road in the area referred to as SFTA (Figures 5 & 6). Groundwater elevation contours presented in the Phase II RI Report (Tetra Tech 2000) indicate groundwater flow in the SFTA is predominantly to the south and southeast in both the surficial and bedrock aquifers. In 1993 and 1998, the highest concentrations of TCE and 1,2-dichloroethene in SFTA groundwater were found in the bedrock aquifer at monitoring well MW-24R, located south of the former Old Hangar. Concentrations of TCE found in the SFTA monitoring

wells have decreased substantially since 1993. The Navy completed an ESD to the OU1 ROD in March 2014 incorporating the SFTA property into the overall OU1 RA. The components of the OU1 selected remedy that apply to the SFTA include MNA and LUCs.

Groundwater monitoring data indicate that the residual contamination in SFTA groundwater is attenuating at a rate consistent with meeting the 20 year remedial timeframe set forth in the ROD.

3.2 OU2 - OLD INCINERATOR ASH DISPOSAL AREA

OU2 was identified during the Initial Assessment Study (IAS) (NEESA 1988). OU2, the Old Incinerator Ash Disposal Area, was located at the north edge of the Northern Activity near the Facility Storage Building. It was estimated that about three tons of classified documents and small quantities of waste paint were incinerated each year at this location. The potential COCs at this site were metals in soils and groundwater. The incineration of paint and film produced approximately 2 pounds of silver, 320 pounds of zinc, 570 pounds of lead, and 190 pounds of chromium over the 19 years of incineration at this site. The IAS concluded that OU2 did not pose a threat to human health and the environment; however, further study of potential contaminant migration was recommended.

The Phase I RI (Dames & Moore 1990a and 1992) and Supplemental Investigation (Dames & Moore 1990b) initially focused on Sites 1 and 2. Metals were found at OU2 at levels that would not pose a health risk.

During the Phase II RI, soil samples were collected and analyzed from soil borings to further characterize ash deposits at OU2. Surface water and sediment samples were collected to evaluate whether or not outfalls and groundwater seeps represent a contaminant migration pathway. It was concluded that metals concentrations in groundwater or sediment did not pose an unacceptable risk. The RI indicated that OU2 had been adequately characterized.

OU2 - Old Incinerator Ash Disposal Area Findings	
Source of Contamination	Incineration of documents, paint, and film wastes over 19 years of incineration at this site.
Nature & Extent of Contamination	<p><i>Soils:</i> SVOC detected in subsurface soil up to maximum concentration of 6,600 µg/kg (phenanthrene). Metals in surface soils detected at maximum concentrations exceeding background levels (lead & zinc) but did not pose a human health risk.</p> <p><i>Surface Water:</i> Groundwater and storm water sediments do not show impact from contamination associated with OU2.</p>
Decision Document "No Action" ROD signed in September 28, 2000.	

The risk assessment conducted as a part of the RI Phase II Report (Tetra Tech 2000) identified no risks in excess of U.S. EPA guidelines related to OU2; however, the RI Phase II Report recommended that a human health risk assessment (HHRA), based on residential site use assumptions, be performed. A HHRA based on residential site use assumptions was conducted and no unacceptable risks were identified. U.S. EPA and the Navy agreed that no further action was required for OU2. The Navy issued a Proposed Remedial Action

Plan (PRAP) for public comment in May 2000. No public comments were received. The Navy and U.S. EPA signed a NFA ROD for OU2 in September 2000. A summary of findings for OU2 is provided above.

3.3 OU3 - COMPONENTS LABORATORY FUEL TANK

OU3, the former Components Laboratory Fuel Tank located at the northeast corner of the Components Laboratory was identified during the IAS (NEESA 1988). This underground storage tank (UST) (20,000-gallon, No. 6 fuel oil tank) supplied fuel for boilers from 1953 to 1982. In 1982, the UST was drained, cleaned, and abandoned in-place due to a leak of approximately 200 gallons of fuel oil to the surrounding soil. An oil/water separator was installed during this time to collect oil and water, which had percolated through the soil as a result of the release. In 1989 the UST and approximately 50 to 75 cubic yards of soil were removed under provisions of the Massachusetts Department of Environmental Quality Engineering (MADEQE) (now the MADEP) Chapter 21E requirements. The potential COCs at this site were total petroleum hydrocarbons (TPH) in soils, and TPH and metals in surface water. The IAS concluded that OU3 did not pose a threat to human health and the environment; however, further study of potential contaminant migration in groundwater was recommended.

During the Phase I RI and Supplemental Investigation (Dames & Moore 1990b and 1992), TPH was found primarily in the soil at Site 2, with only low concentrations in the groundwater, thus indicating that limited leaching from soil to groundwater had occurred.

OU3 – Components Laboratory Fuel Tank Findings	
Source of Contamination	Leak of approximately 200 gallons of fuel oil to the surrounding soil from UST, prior to 1982.
Nature and Extent of Contamination	<p><i>Sediment:</i> SVOC detected at maximum concentration of 28,000 µg/kg (fluoranthene). VOC detected at maximum concentration of 58J µg/kg (acetone). Lead, nickel, and zinc exceed ERM.</p> <p><i>Groundwater:</i> Groundwater does not show impact from contamination associated with former Components Laboratory Fuel Tank.</p>
Decision Document	“No Action” ROD signed in September 28, 2000.

During the Phase II RI, the Navy found elevated concentrations of semi-volatile organic compounds, lead, nickel, and zinc in a sediment sample located east of the Vitro Tower and north of the Components Building. These chemicals were most likely the result of the former leaking UST. The RI Phase II report indicated that Site 2 had been adequately characterized.

The risk assessment conducted as part of the RI Phase II Report (Tetra Tech 2000) identified no risks in

excess of U.S. EPA guidelines related to OU3; however, similar to OU2, it was recommended that a HHRA using residential site use assumptions be performed.

A HHRA based on residential site use was performed and no unacceptable risks were identified. The Navy and U.S. EPA agreed that NFA was required for OU3. In May 2000, the Navy issued a

PRAP for public comment. No public comments were received. The Navy and U.S. EPA signed a NFA ROD for the site in September 2000. A summary of findings for OU3 is provided above.

3.4 OU4 - BTEX PLUME

OU4 — the BTEX plume — was identified during the Phase II RI. OU4 is associated with releases from the former Transportation Building and its UST. The Transportation Building operations included vehicle maintenance activities (e.g., repairs, oil changes, etc.) and equipment storage. Oil stains on the floor suggest that small amounts of waste petroleum products may have been released to the ground. A 7,600-gallon gasoline UST was in use adjacent to the Transportation Building from 1960 through 1984. In 1984, this UST failed a tightness test and the UST and associated piping were subsequently removed in December 1988 and January 1989 along with approximately 75 to 100 cubic yards of contaminated soil. These actions were documented in a 31 January 1989 letter from Brian Balukonis of Raytheon to Elizabeth Callahan of MADEQE; the letter stated that further evaluation of this UST should take place under the IR program.

Subsequent investigations identified a narrow BTEX plume in groundwater that has migrated to the north of the Transportation Building, down the slope of Hartwells Hill to an off-property wetland area (Figure 7).

The RI Phase II Report recommended a FS for OU4. Subsequent to submitting a final FS in March 2001, the Navy, as described for OU1, completed an addendum to the baseline risk assessment presented in the RI Phase II report. This addendum was issued in October 2001 and included an evaluation of risks if site groundwater were to be used as a drinking water supply onsite; the calculated risk exceeded U.S. EPA guidance levels.

From November 2000 through early 2003, the Navy conducted a removal action using in-situ chemical oxidation (ISCO) for the OU 4 source area. In April 2002, the Navy issued a PRAP recommending ISCO for the source area, followed by MNA of the residual plume. Although the ISCO treatment reduced source area contaminant concentrations, the desired cleanup goal of 300 µg/L (Benzene) was not achieved throughout the treatment area and additional remedial measures were deemed appropriate.

In 2003, the Navy conducted a second removal action involving in-situ thermal treatment of the OU4 source area which appeared to be successful for reducing source area contaminant concentrations. Subsequently, the Navy conducted semi-annual groundwater monitoring and evaluated MNA at OU4. A MNA assessment report was issued in September 2008. The monitoring data at that time indicated that BTEX concentrations in source area groundwater had slightly rebounded since the 2003 removal action and it was believed that some residual BTEX remained in source area soil.

OU4 — BTEX Plume Findings	
Source of Contamination	A release of BTEX resulting from former garage operations and a leaking gasoline UST (formerly located to the south of the Transportation Building, prior to 1984). The UST was removed in 1989.
Nature and Extent of Contamination	<p><i>Soils:</i> BTEX compounds detected in soil vapor. BTEX detected in soil at maximum concentration of 35,000 µg/kg (xylenes).</p> <p><i>Groundwater:</i> BTEX detected in groundwater at maximum concentration of 2,160,000 µg/L (ethylbenzene). BTEX concentrations in excess of MCLs in several locations.</p>
Decision Document	Record of Decision 9/29/09
Remedial Action Objectives (RAOs)	<p>1. Eliminate potential future risks to humans using groundwater from OU 4 as a drinking water supply by restoring the aquifer to drinking water quality by reducing COC concentrations to below federal and state maximum contaminant levels (MCLs) and federal non-zero maximum contaminant level goals (MCLGs), or, if an MCL or MCLG is not available for a chemical, reducing COC concentrations to below a site-specific risk-based cleanup level.</p> <p>2. Minimize or eliminate the migration of COCs from the source area to the groundwater plume by reducing COC concentrations in the source area.</p>
Remedial Action	<p>The Navy completed three source area removal actions: (1) removal of the UST and surrounding soil in 1989; (2) in-situ chemical oxidation from 2000 to 2003 and (3) in-situ thermal treatment (electrical resistance heating) in 2003. The Navy conducted MNA sampling of the residual groundwater plume as part of a semi-annual groundwater monitoring program from 1997 to 2009.</p> <p>A ROD was signed in September 2009. The selected remedy includes (1) PDI of source area soil; (2) selective excavation of the source area based on the PDI results; (3) on-site treatment of the excavated soil using bioremediation (biopiles) or offsite disposal; (4) onsite treatment and discharge of any water from the excavation (if dewatering is required); (5) potential application of enhanced bioremediation in the excavated source area; (6) MNA of the groundwater plume; (7) institutional controls; and (8) five-year reviews.</p> <p>A draft Remedial Design for excavation was prepared; however, based on the March 2010 PDI results, it was determined that source area excavation was not required. Currently, MNA is being conducted for the residual groundwater plume (maximum total BTEX concentration of 943 µg/L). Updated Sampling and Analysis Plans were prepared in November 2011 and March 2012. Additional monitoring wells were installed in September 2012. The Remedial Action was considered complete by EPA on August 8, 2013. A 5-year review was completed in September 2014. Remedial timeframe is 9 years (2023).</p>

In June 2009, the Navy issued a new PRAP (superseding the 2002 PRAP) in which the Navy recommended additional source area excavation, followed by MNA of the residual groundwater plume, LUCs, and 5-year reviews. The PRAP was approved by the public and regulatory agencies and the final ROD was signed in September 2009. The Navy then commenced the Remedial Design

and conducted a Pre-Design Investigation (PDI) in March 2010 to delineate the extent of BTEX in source area soil. Based on those results, it was determined the threshold criteria for additional source area excavation had not been met.

The Navy is continuing with the MNA portion of the RA and it is anticipated that cleanup goals will be achieved within 9 years (by 2023). Quarterly monitoring of the OU4 groundwater plume began in 2012 and is still ongoing. A summary of findings for OU4 is included above.

In March 2013, the Navy conducted groundwater monitoring at OU4 as part of the first quarterly and first semi-annual monitoring event. Results of the event indicate that cleanup goals remain in exceedance at two wells, however concentration trends indicate a decrease. Even in instances of periodic slight year over year upticks, the decreasing trends are expected to continue. The Navy continues to monitor the well network and evaluate MNA performance. Proposed timeframes for achieving RAOs contained in the 2009 OU4 ROD (<10 years) have been revised upward to 14 years (2023). A site inspection was conducted on May 1, 2013 to verify site conditions.

4.0 INSTITUTIONAL CONTROLS

NWIRP was an active industrial research facility from the mid-1950s until December 2000. Since that time, the facility has remained vacant and inactive except for the operation of remediation systems. NWIRP is fenced and gated to control access, however trespassing by teenagers and adults has been observed and some vandalism has occurred. The Town of Bedford zoning for the majority of the NWIRP property is zoned as “Industrial Park (A).” The offsite area north of the Components Laboratory, including the wetland area, is zoned as “Residential B.” Naval Sea Systems Command has considered the property excess since December 2000 and intends to transfer the property after all CERCLA requirements have been satisfied. The foreseeable future use of NWIRP is expected to be similar to the current use pattern (i.e., industrial use). The offsite land use surrounding the NWIRP property are also expected to be similar (i.e., mix of commercial/industrial and residential uses). Further residential development between Elm Brook and the facility boundary is unlikely due to the presence of the wetlands.

In accordance with OU1, SFTA, and OU4 decision documents, LUCs have been implemented at each site as contaminants have been left in place at levels that do not allow for Unlimited Use/Unrestricted Exposure (UU/UE). The LUCs ensure that remaining contamination does not pose an unacceptable risk to human health (Figure 8).

Specific Land Use Controls (LUCs) at NWIRP are:

- Prohibit use of the groundwater aquifer as a drinking water supply until groundwater COC concentrations achieve cleanup goals. For private properties within the LUC boundary, The Navy will coordinate with the Town of Bedford Board of Health and monitor the Town’s implementation of the municipal Code of Health Regulations which control the installation and use of private water wells.

- Prohibit residential redevelopment of the NWIRP property until a CERCLA risk assessment is performed to quantitatively demonstrate that soils pose no unacceptable risks to future residents⁹. The Navy will coordinate with the Town to monitor any proposal to develop for residential use any of the privately-owned property within the NWIRP LUC Area
- Restrict occupancy of current and future site structures until a CERCLA risk assessment is performed to quantitatively demonstrate that vapor intrusion poses no unacceptable risks.
- LUC monitoring will be conducted by the Navy to verify LUCs are being properly implemented and that the LUC objectives are being met. The Navy will notify EPA Region 1 and the Commonwealth of Massachusetts 45 days in advance of any proposed change in land use that would require modifications to the LUCs to remain consistent with the LUC objectives or the selected remedy
- Obtain EPA Region 1 concurrence, in consultation with the Commonwealth of Massachusetts, prior to modifying or terminating the LUCs or implementation actions.
- Evaluate the effectiveness of LUCs as part of each five-year review. The first five-year review will be completed in 2014. Five-year reviews will be submitted to EPA Region 1 and the Commonwealth of Massachusetts for review per the FFA.

In accordance with the above LUCs, annual LUC inspections (Tetra Tech, December 5, 2011, October, 3, 2012, October, 24, 2013) indicate compliance with conditions set forth in applicable decision documents. The Navy will maintain institutional controls at NWIRP until the concentrations of hazardous substances have been reduced to levels that allow for UU/UE, as determined by the monitoring program.

5.0 DEMONSTRATION OF CONSTRUCTION QA/QC

The methods, procedures, inspections and tests were performed in accordance with various Quality Assurance Plans prepared as part of the EPA and MADEP-approved remedial designs. Specific Navy Quality Control Plans implemented and verified by EPA's Remedial Project Manager include:

- *Revised Final Sampling and Analysis Plan for Long-Term Groundwater Monitoring*. NWIRP Bedford, MA. March 2009
- *Sampling and Analysis Plan for Site 3 Source Area Investigation*. NWIRP Bedford, MA. February 2010
- *Sampling and Analysis Plan for Site 4 (BTEX Plume) Pre-Design Investigation*. NWIRP Bedford, MA. March 2010
- *Letter Report Regarding Updated Sampling and Analysis Plan for Groundwater Monitoring Program at Southern Flight Test Area*. NWIRP Bedford, MA. 24 February 2011
- *Final Sampling and Analysis Plan for Monitoring Sites 3, 4, and Southern Flight Test Area for Fall 2011*. NWIRP Bedford, MA. 1 November 2011
- *Final Remedial Action Work Plan (RAWP) for Site 3 – Chlorinated Solvent Groundwater Plume and Site 4 – BTEX Plume*, NWIRP Bedford, MA. April 23, 2012

- *Final Sampling and Analysis Plan for Monitoring Sites 3, 4, and Southern Flight Test Area 2012 through 2014.* NWIRP Bedford, MA. 1 October 2012
- *Final Sampling and Analysis Plan for Supplemental Groundwater and Soil Gas Sampling Southern Flight Test Area.* NWIRP Bedford, MA. 1 January 2013
- *Final Construction Completion Report, Remedial Construction Activities, Site 3 Chlorinated Solvent Groundwater Plume and Site 4 BTEX Plume.* NWIRP Bedford, MA. February 2014
- *Sampling and Analysis Plan Addendum 1, Groundwater Monitoring at Site 3, Site 4, and Southern Flight Test Area, 2012-2014.* NWIRP Bedford, MA. 12 March 2014
- *Final Sampling and Analysis Plan Groundwater Investigation for Emerging Contaminants at Site and Southern Flight Test Area.* NWIRP Bedford, MA. November 2014

A pre-final inspection was conducted on September 23, 2013 to verify all site remedial conditions. All components of the remedy were constructed in accordance with EPA-approved plans and specifications. No outstanding items were identified. Construction of all Remedies (including where amended by ESD (EPA Doc ID #557956)) is complete and are functioning as designed Remedial components such as such as groundwater treatment, in-situ enhanced bioremediation, MNA, and LUCs continue under the direction of the Navy. The construction of on-going components is complete and is consistent with the ROD, ESD, and remedial design plans and specifications. No outstanding items were identified for on-going components.

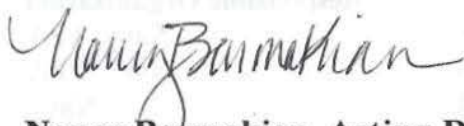
6.0 SCHEDULE OF ACTIVITIES FOR SITE COMPLETION

It is estimated that all activities associated with site completion will be performed according to the schedule below:

Schedule for Site Completion		
Task	Date	Responsible Organization
Institutional Controls – Deed Restriction	9/30/2015	Navy, EPA
Second Five-Year Review (every 5 years thereafter)	9/30/2019	Navy, EPA
Complete Groundwater Treatment	9/30/2094	Navy
Final Site Inspection	9/30/2094	EPA, Navy
Final Closeout/Final Remedial Action Report	9/30/2095	EPA
Propose Site Deletion from NPL	9/30/2095	EPA
NPL Site Deletion	9/30/2096	EPA

Hazardous substances will remain at the Site above levels that allow unlimited use and unrestricted exposure after the completion of the action. Pursuant to CERCLA §121(c) and as provided in the current guidance on Five-Year Reviews (OSWER Directive 9355.7-03B-P, June 2001), EPA must conduct statutorily required Five-Year Reviews. The first Five-Year Review was conducted in 2014. The Five-Year Reviews concluded that the selected remedies are protective of human health and the environment. The next Five-Year Review is scheduled for 2019.

Approved by:



Nancy Barmakian, Acting Director
Office of Site Remediation and Restoration

Date 04/01/15

APPENDIX A: FIGURES

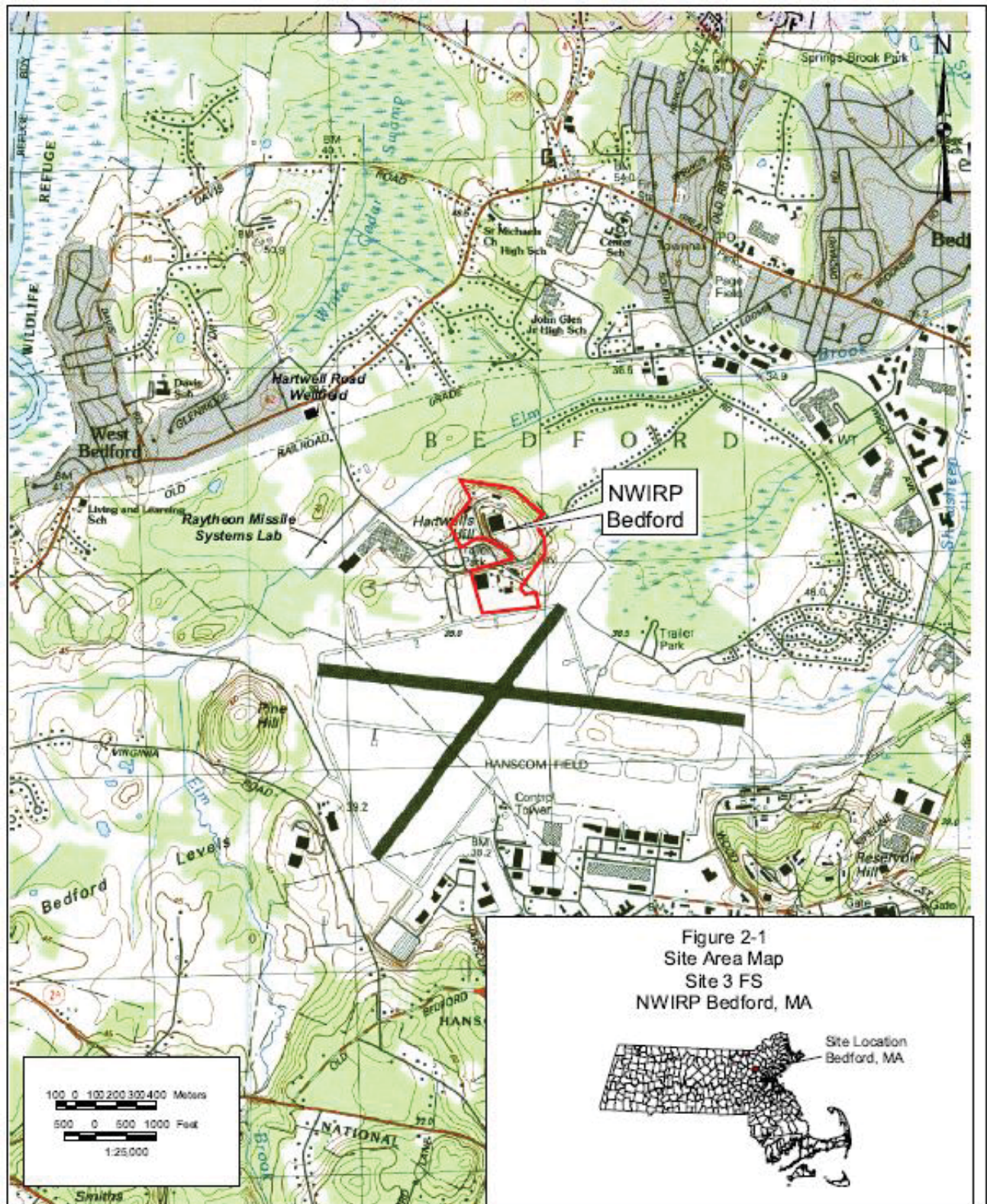


FIGURE 1 – LOCATION MAP

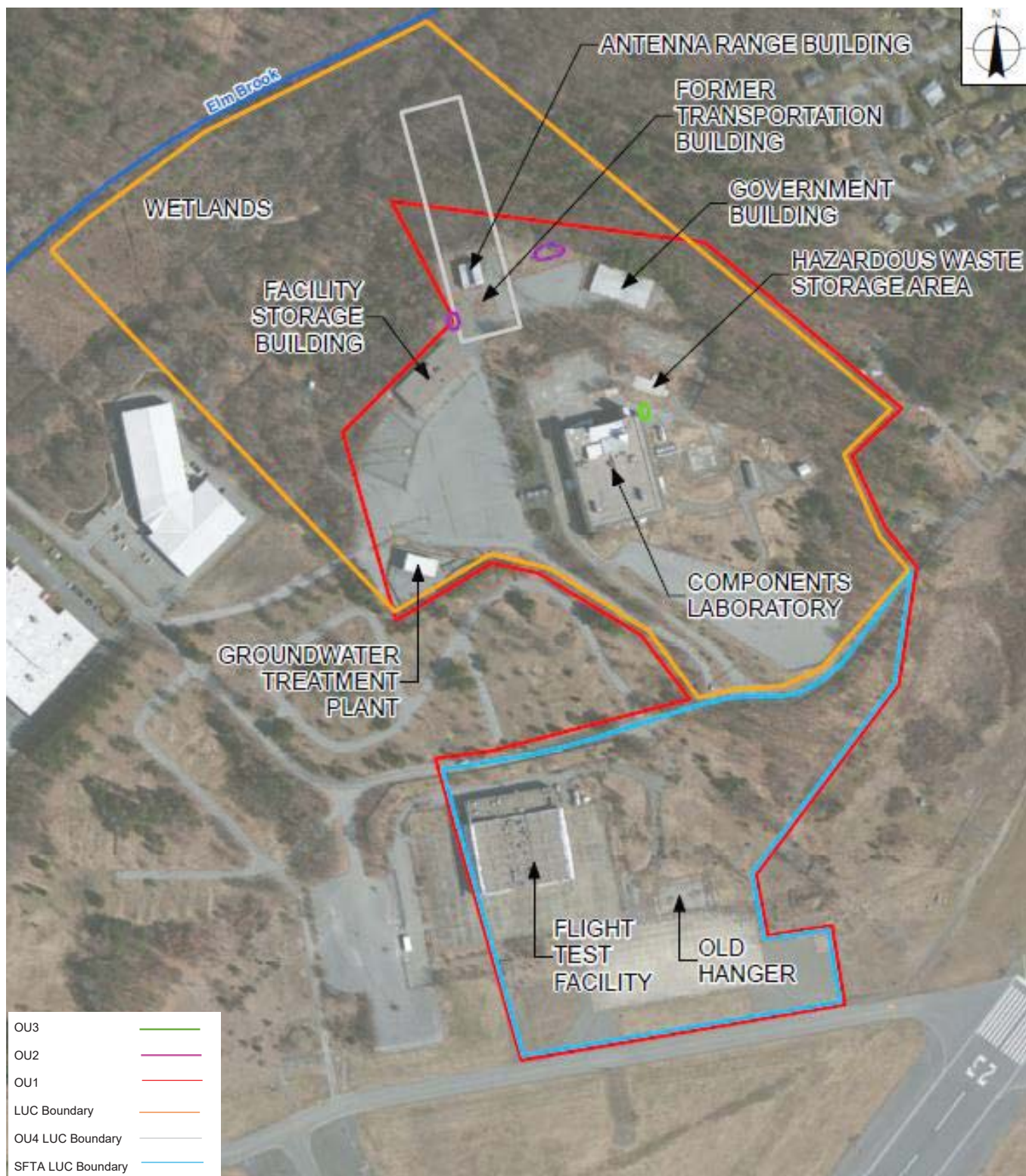


FIGURE 2 – SITE MAP

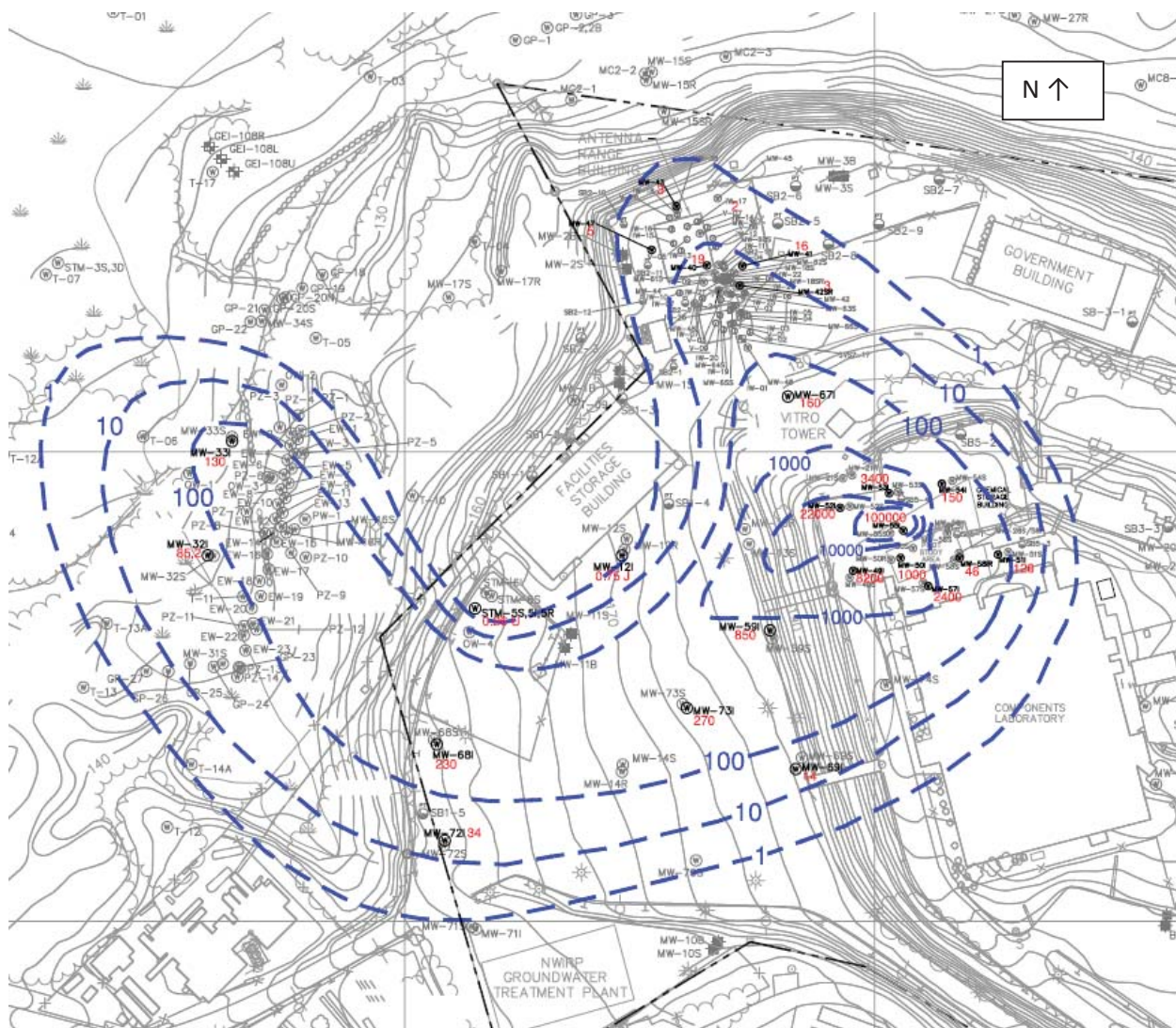


FIGURE 3 – OU1 PLUME MAP (TCE CONTOURS µg/L)

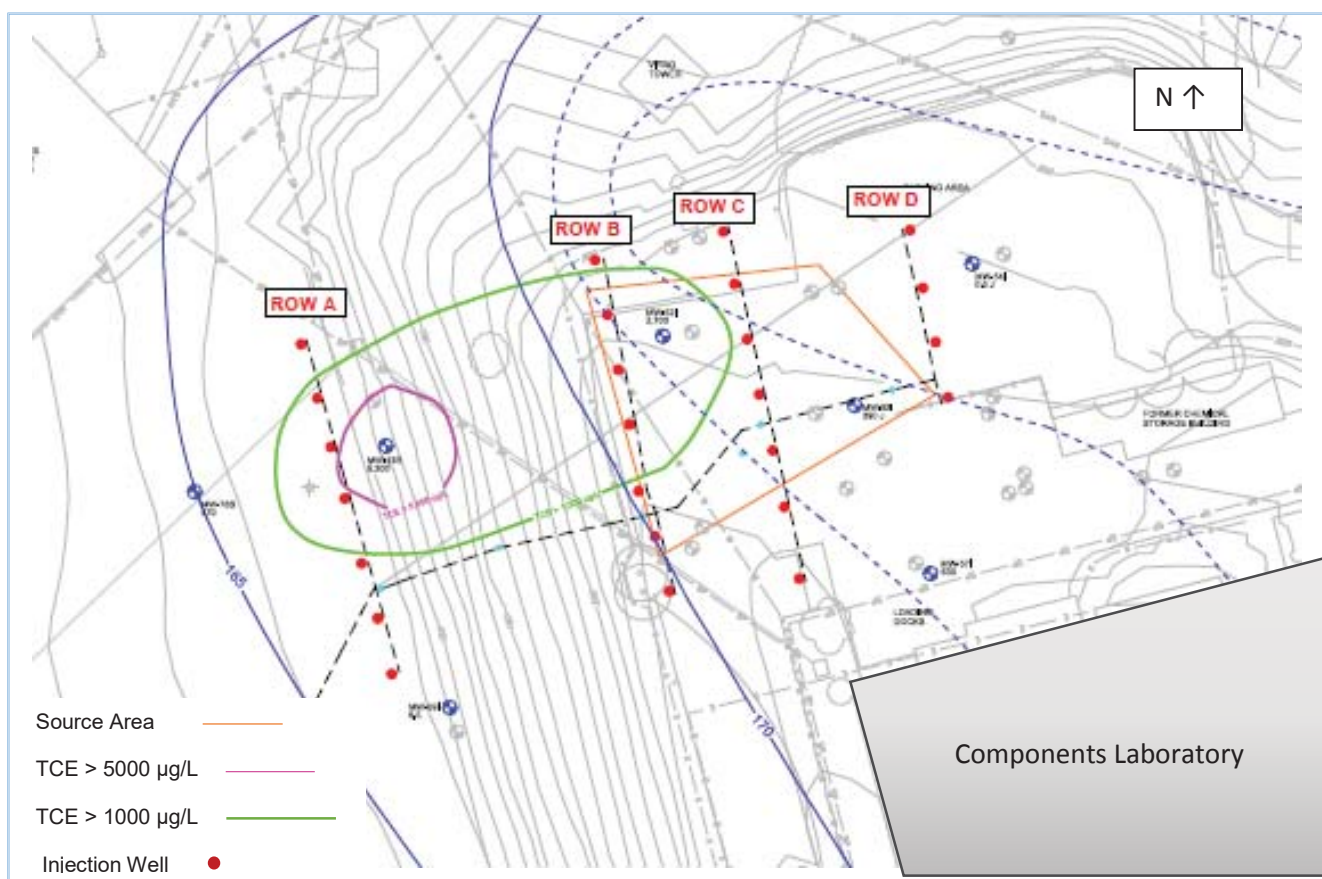


FIGURE 4 – OU1 INJECTION WELLS



FIGURE 5 – OU1 MAP

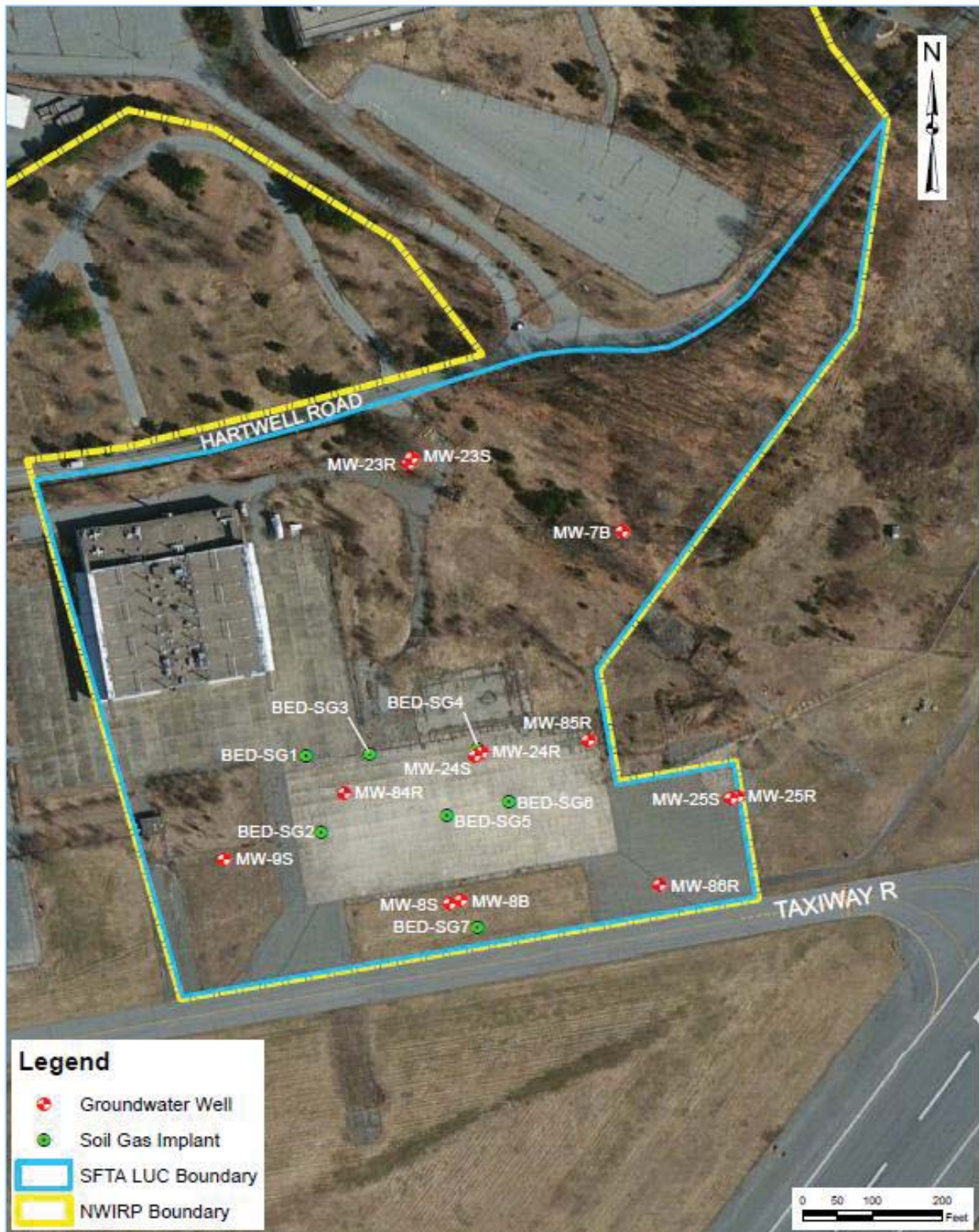


FIGURE 6 – SFTA MAP

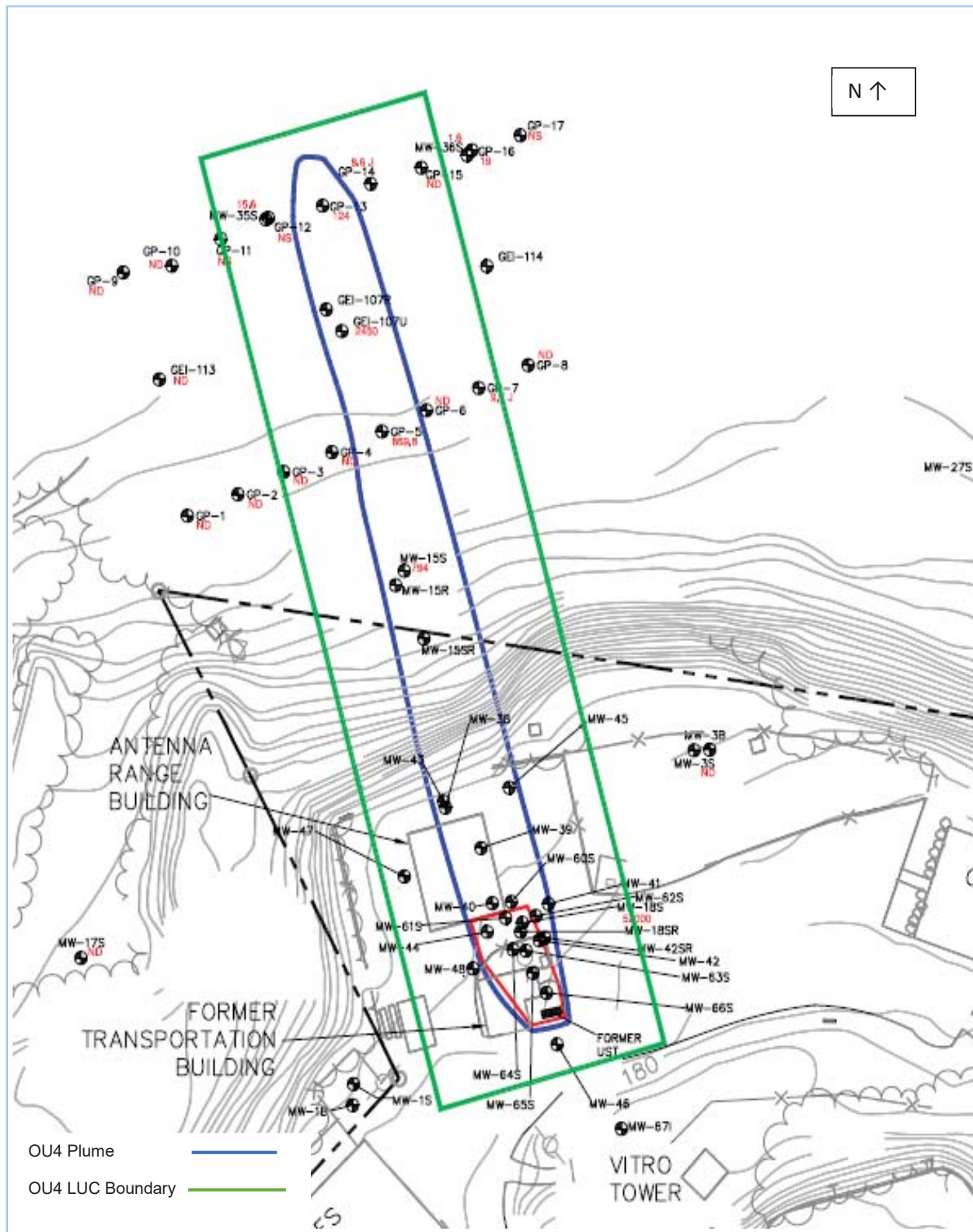


FIGURE 7 – OU4 MAP



FIGURE 8 – LUC BOUNDARY MAP